Name: ______________________________ Date: ______________

Polynomial Operations SOLUTIONS (version 40)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -2x^5 + 10x^4 + 8x^3 - 5x^2 - 7$$

$$q(x) = 8x^5 + 7x^4 + 5x^3 - 10x - 2$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$p(x) = (-2)x^5 + (10)x^4 + (8)x^3 + (-5)x^2 + (0)x^1 + (-7)x^0$$
$$q(x) = (8)x^5 + (7)x^4 + (5)x^3 + (0)x^2 + (-10)x^1 + (-2)x^0$$
$$p(x) + q(x) = (6)x^5 + (17)x^4 + (13)x^3 + (-5)x^2 + (-10)x^1 + (-9)x^0$$
$$p(x) + q(x) = 6x^5 + 17x^4 + 13x^3 - 5x^2 - 10x - 9$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -7x^2 + 6x - 8$$

$$b(x) = -8x - 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-7x^2$	$6x$	-8
$-8x$	$56x^3$	$-48x^2$	$64x$
-4	$28x^2$	$-24x$	32

$$a(x) \cdot b(x) = 56x^3 - 48x^2 + 28x^2 + 64x - 24x + 32$$

Combine like terms.

$$a(x) \cdot b(x) = 56x^3 - 20x^2 + 40x + 32$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= x^3 + 12x^2 + 26x - 1 \\ g(x) &= x + 9 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+9}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 1 & 12 & 26 & -1 \\ -9 & & -9 & -27 & 9 \\ \hline & 1 & 3 & -1 & 8 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = x^2 + 3x - 1 + \frac{8}{x+9}$$

In other words, $h(x) = x^2 + 3x - 1$ and the remainder is $R = 8$.

5. Let polynomial $f(x)$ still be defined as $f(x) = x^3 + 12x^2 + 26x - 1$. Evaluate $f(-9)$.

You could do this the hard way.

$$\begin{aligned} f(-9) &= (1)\cdot(-9)^3 \ + \ (12)\cdot(-9)^2 \ + \ (26)\cdot(-9) \ + \ (-1) \\ &= (1)\cdot(-729) \ + \ (12)\cdot(81) \ + \ (26)\cdot(-9) \ + \ (-1) \\ &= (-729) \ + \ (972) \ + \ (-234) \ + \ (-1) \\ &= 8 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-9)$ equals the remainder when $f(x)$ is divided by $x + 9$. Thus, $f(-9) = 8$.